PATENT
H0003569-3144

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Derek Raybould et al.	:	Confirmation No.: 1262
Serial No. 10/621,071	:	Group Art Unit: 1725
Filed: July 14, 2003	:	Examiner: Jonathan J. Johnson

For: LOW COST BRAZES FOR TITANIUM

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION OF DEREK RAYBOULD UNDER 37 C.F.R. 1.132

I, DEREK RAYBOULD, declare that:

1. I reside at 2 Horizon Drive, Denville, NJ 07834, and make this declaration of my own knowledge and belief.

2. I am a Senior Principle Scientist for Honeywell, Inc. ("Honeywell"). I am presently employed by Honeywell, and my office is located at Morristown NJ.

3. I received a Bachelors degree in Material Science & Metallurgy in 1968 from Imperial College, London University, UK and a Doctorate degree in Mechanical & Physical Metallurgy in 1971 from Imperial College London University, UK. I have worked on materials for aircraft at Honeywell for over 24 years.

4. At Honeywell I have worked on a variety of brazes for aluminum, titanium and superalloys, both as a user and supplier of braze powders. I worked for 4

years with Dr John Vollmer on titanium heat exchangers. During this time he wrote and filed US Patent 6,149,051, the content of which he discussed with me.

4. I am one of the inventors named in U.S. Patent Application No. 10/621,071 (the "current application"), filed July 14, 2003.

5. The current application is directed to a low cost braze for titanium. The claims of the current application are directed to improved brazes for titanium, especially for heat exchanger applications.

6. It is generally known in the art that a repeatable uniform and consistent melt (braze) temperature is desirable, that this is best achieved by a prealloyed powder, and that the use of more expansive techniques such as rapid solidification to achieve an even more consistent and uniform melt temperature is often warranted and necessary to achieve good brazes.

7. It is generally known in the art that while a wide range in braze temperature is desirable, a small change (+10°C) in melt (braze) temperature will result in either no brazing occurring if the melt temperature increases, or, if the melt temperature decreases, then melting will lead to erosion of the substrate i.e. melt through, both of which cases are unacceptable. This latter effect is of critical importance for thin sections as occur in a heat exchanger.

8. It is generally known in the art that braze chemistry must be carefully controlled and checked and that periodically the melt temperature of the braze

must be reconfirmed, usually with each new batch in order to avoid the above problems.

9. It is generally known in the art that once a braze procedure has been established, then changes of +10°C in the furnace temperature, due, for example, to a poor thermocouple or of the braze melt temperature due, for example, to the braze chemistry being off specification, will result in problems with the braze joint. This being especially true for brazing thick to thin sections, for large parts and for brazing alloys, all of which apply to heat exchangers.

10. It is generally known in the art that a braze should have a solidus and liquidus temperature that are close together. Preferred braze compositions are therefore eutectics or similar, which have the same solidus and liquidus. These compositions quickly melt at one temperature, but eutectics are at the bottom of troughs and a very small variation in chemistry will result in a large increase in melt temperature, i.e., the eutectic composition must be maintained. How tightly depends on the alloy.

11. It is generally known in the art that braze chemistry must be tightly controlled and typically is specified to +-1% for critical elements, such as Zr and perhaps +-3% for less critical elements such as Ti. In fact, the Honeywell specification for TiCuNiZr, originally written by J. Vollmer, follows this rule and has Ti controlled at less than 3%. The greater the number of key elements, e.g., Zr, Ni, Cu, the tighter this specification must be.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the Subject Application or any patent which issues thereon.

Derek Raybould

Dated: January 25, 2007